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14. ABSTRACT

Sea ice from the Kara Sea is widely distributed: to the Laptev Sea in the east, to the Transpolar Drift Stream in the Arctic Basin to the north, and to the Barents Sea in the west. Although this distribution raises the potential for widespread distribution of ice contaminated by radionuclides, values obtained in this study were low, due to the location of sampling, and other factors.

See extended abstract appended for more information.

15. SUBJECT TERMS

radionuclides, sea ice, Arctic, Kara Sea.

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Incorporation of Radionuclides in Arctic Sea Ice
S. Pfirman and R.F. Anderson July 1, 1995 - June 30, 1999

The purpose of the grant was to better understand the conditions under which sea ice incorporates and transports radionuclides, and identify locations where incorporation of radionuclides by sea ice is of concern.

Our study focused on the Kara Sea, which is the sea most likely to be contaminated by atmospheric, riverine and marine sources. Our research showed that sea ice from the Kara Sea has a strong influence on the Laptev Sea, Barents Sea, Svalbard, the southern portion of the Transpolar Drift Stream and eastern Fram Strait (Pfirman et al., 1997a). Previous investigations had overlooked ice flux to the Laptev and Barents seas, and thus considered the Kara Sea to be a minor source of ice. Our estimates indicate that total ice flux from the Kara Sea is ca. 408,000 km^2, which is actually more than the ca. 350,000 km^2 estimated by other investigators for the "ice factory" of the Arctic, the Laptev Sea (Pfirman et al., 1997b).

Another important finding is that there are large interannual variations in the fate of ice exiting the Kara Sea (Pfirman et al., provisionally accepted). Hardly any of the 1979-1980, 1982-1983, 1985-1987, and perhaps 1995-1996 ice from the northern Kara Sea was advected into the Laptev Sea. On the other hand, in 1989-1991 there was strong advection of ice into the Laptev Sea from the Kara Sea. This easterly advection reached a maximum in 1991, when ice from the Kara Sea was advected actually to the east of the New Siberian Islands. Also, in 1986-1988 and 1991-1995 there was a strong advection of ice from the Kara Sea directly into the Barents Sea to the south of Frans Joseph Land. Usually Kara Sea ice is advected to the north and enters the Barents Sea through the passage between Svalbard and western Frans Joseph Land.

Our research also showed that ice originating in the vicinity of the Vize Islands, is likely to entrain greater amounts of sediment into ice of the central Arctic pack, than ice that originates in other parts of the Kara Sea (Pfirman et al., 1997a). Because radionuclides are often associated with sediments and these islands are quite remote from sources of radionuclides, this means that sediment-laden ice sampled in the Arctic basin that originated from the Kara Sea is not as likely to contain elevated concentrations of radionuclides as was thought earlier.

In a related effort to identify potential local sources of radionuclide contamination in the Kara Sea, we took advantage of an opportunity to collect ice, water and sediment samples during a cruise of the Russian research vessel ice breaker Ivan Petrov in August and September, 1995. We found concentrations of 137Cs between 2 and 3 Bq/m3 in seawater, and roughly an order of magnitude lower in water from the Ob River. Concentrations of 239+240Pu in sediment ranged from 0.07 to 2 Bq/kg. Only one sample of river sediment could be collected, and this had a Pu concentration (0.17 Bq/kg) within the range of values for marine sediments. Similarly, sediment recovered from a melt pond on sea ice had a Pu concentration (0.67 Bq/kg) within the range of values observed for marine sediments. Our results showed no evidence for significant local sources of these radionuclides.

Publications

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